## REMARKS

In reply to the Final Office Action of February 13, 2008, Applicant has amended claim 13 and added new claim 18. No claims have been canceled. Accordingly, claims 1-9 and 12-18 are pending, with claims 1 and 17 in independent form.

In the present reply, claim 13 has been amended to correct a typographical error. Specifically, claim 13 has been amended to depend from claim 12 rather than from canceled claim 10.

Claims 1, 2, 4-8, 12-15, and 16 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Applicant's admitted prior art (DE 195 06 093 02, "APA") in view of Spaeth (U.S. Patent No. 5,812,570, "Spaeth"). Independent claim 1 covers semiconductor devices that include, in part, "a beam-collimating device, wherein the laser diode bar and the beam-collimating device are disposed on a common surface of the cooling element." The Action admits that APA "does not illustrate the lens on a common surface of the cooling element" (Action at page 4), but states that "rearrangement of the collimating lens is considered an obvious design choice because the collimating [lens] regardless of its position would provide the same function of collimating the beam, thereby the positioning of the lens does not modify the operation of the claimed invention" (id.). Applicant respectfully disagrees.

As explained in Applicant's reply to the previous Office Action of June 26, 2007, Applicant has recognized that improved cooling efficiency can be achieved by positioning laser bar 12 away from the edge of cooler 20, as shown in Figure 1 of Applicant's specification, thereby increasing the cross-sectional area 34 of cooler 20 through which heat flows from laser bar 12 to the cooling channels within cooler 20. Increasing the cross-sectional area of the region of heat flow leads to more efficient cooling of Applicant's laser bars relative to APA's laser bars, for example. A beam collimating device, such as a lens, is used for collimating a laser beam emitted by laser bar 12. Collimating lenses are mounted such that they remain fixed in position with little deviation during operation of laser bar 12. Small deviations in the position of a collimating lens can lead to a reduction in the efficiency of the collimation provided by the lens.

Applicant does not agree that the claimed semiconductor devices, in which "the laser diode bar and the beam-collimating device are disposed on a common surface of the cooling element," amount to a mere rearrangement of parts relative to APA, as the Action apparently alleges. In the devices disclosed by APA (see, e.g., Figure 2 of Applicant's specification), laser bar 12 is positioned at an edge of cooler 20. There is simply no room to insert lens 62 between laser bar 12 and the edge of cooler 20.

Moreover, one of skill in the art at the time of the invention would have had no reason to position lens 62 and laser bar 12 on a common surface of cooler 20. As discussed in Applicant's specification, due to the absence of a microstructured region under laser bar 12 in APA's devices, "[a] region 54 of heat flow is therefore created" (specification at page 1, lines 23-24). One of skill the art would have recognized that, due to the region of heat flow 54, the upper surface of cooler 20 would undergo significant thermal expansion and/or contraction, according to the rate and quantity of heat dissipated from laser bar 12 to cooler 20. If lens 62 was positioned on the upper surface of cooler 20, the position of lens 62 would change as the surface of cooler 20 expanded and/or contracted according to the transfer of heat between laser bar 12 and cooler 20. As discussed above, one of skill in the art would have recognized that changes in the position of lens 62 would lead to unacceptable variation in the collimating properties of lens 62.

In contrast, due to improved heat dissipation in Applicant's semiconductor devices relative to APA's devices, the influence of heat transfer on the expansion and/or contraction of upper surface 20 is significantly reduced in Applicant's devices. Therefore, lens 40 (see Figure 1 of Applicant's specification) and laser bar 12 can be mounted on a common surface of cooler 20, and the collimating properties of lens 40 can be maintained during operation of the devices because positional deviations of lens 40 are significantly reduced. At the same time, the complexity of the semiconductor devices is reduced, because auxiliary mounting 60 is no longer used to support the collimating lens.

Accordingly, one of skill in the art would have had no reason to modify APA so that "the laser diode bar and the beam-collimating device are disposed on a common surface of the cooling element." In contrast, because of the significant heat transfer that occurs through the upper surface of cooler 20 in APA's devices, a person of skill in the art would *not* have

positioned lens 62 on the upper surface of cooler 20. Instead, the person of skill in the art would have decoupled lens 62 from the upper surface of cooler 20 to ensure that the position of lens 62 relative to laser bar 12 remained largely unchanged, in spite of the heat transfer between laser bar 12 and cooler 20.

Applicants believe that MPEP 2144.04 VI C, to which the Action refers (see Action at page 4), is consistent in this regard. Specifically, MPEP 2144.04 VI C refers to *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984), which stated that:

> The mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims on appeal is not by itself sufficient to support a finding of obviousness. The prior art must provide a motivation or reason for the worker in the art, without the benefit of appellant's specification, to make the necessary changes in the reference device. (*Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984)).

Applicant submits that APA provides no reason for a person of skill in the art to modify APA's devices so that "the laser diode bar and the beam-collimating device are disposed on a common surface of the cooling element." To the contrary, as discussed above, the person of skill in the art would have recognized that heat transfer from laser bar 12 to cooler 20 through the upper surface of cooler 20 in APA's devices would have prevented such a collimating element from maintaining proper collimation of the output of laser bar 12 as the surface of cooler 20 expanded and/or contracted during heat transfer.

Applicant does not concede that APA and Spaeth can be combined as proposed in the Action. However, even if, for the sake of argument only, APA and Spaeth were combined, the combination still would not yield the semiconductor devices covered by claim 1, at least because Spaeth fails to provide any disclosure or suggestion regarding a beam collimating element.

Accordingly, Applicant submits that claim 1 is patentable over both APA and Spaeth, and respectfully requests reconsideration and withdrawal of the rejection of claim 1 under 35 U.S.C. § 103(a).

Claims 2, 4-8, 12-15, and 16 depend from claim 1 and are therefore patentable over both APA and Spaeth for at least the same reasons. Accordingly, reconsideration and withdrawal of the rejection of these claims under 35 U.S.C. § 103(a) is also respectfully requested.

Claims 3 and 9 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over APA in view of Spaeth, Hall (U.S. Patent No. 4,525,178, "Hall"), and Razeghi et al. (U.S. Patent No. 5,012,476, "Razeghi"). Each of claims 3 and 9 depends from claim 1, and is therefore patentable over both APA and Spaeth for at least the same reasons as claim 1, as discussed above. Furthermore, neither Hall nor Razeghi cures the deficiencies of APA and Spaeth with regard to claim 1, at least because neither Hall nor Razeghi discloses or suggests semiconductor devices in which "the laser diode bar and the beam-collimating device are disposed on a common surface of the cooling element," as required by claim 1.

With regard to claim 9, the Action states that "Hall discloses in column 1 lines 28-32 a diamond composite material, which has a high modulus of elasticity" (Action at page 6), and further states that "it would have been obvious to a person of ordinary skill in the art to combine the diamond composite material of Hall with the APA of figure 2, due to its high modulus of elasticity" (id.). Applicants respectfully disagree.

Applicants agree that Hall discloses that polycrystalline diamond can have a high modulus of elasticity. With regard to connection plate 3, Spaeth states that "if a connection plate material having a high modulus of elasticity is used, a hard solder, such as an AuSn alloy, is also suitable" (Spaeth, col. 5, lines 16-18). In other words, Spaeth discloses that in certain circumstances, connection plate 3 can be formed of a material having a high modulus of elasticity. But, connection plate 3 does not have to be formed of a material having a high modulus of elasticity.

However, Spaeth also discloses that connection plate 3 "***must have good electrical and thermal conductivity***, since at least the connection plate 3 is used both to supply current and to dissipate heat" (Spaeth, col. 4, lines 46-48, emphasis added). Spaeth further states that "connection wire 37 is bonded or soldered to the connection plate 3, which is used as both a thermal and an electrical connection for the semiconductor body 1" (Spaeth, col. 4, lines 13-15). According to Spaeth, an exemplary material that satisfies these requirements for connection plate 3 is molybdendum (see, e.g., Spaeth, col. 4, line 49).

Therefore, notwithstanding whether connection plate 3 is formed from a material having a high modulus of elasticity or a low modulus of elasticity, Spaeth explicitly requires that connection plate 3 must have good electrical and thermal conductivity. In particular, because Spaeth's connection plate 3 is used to supply electrical current to a laser diode component, Spaeth's disclosure implies that connection plate 3 should have an electrical conductivity that is comparable to the electrical conductivity of a metal such as molybdenum.

However, there is simply no evidence that Hall's polycrystalline diamond materials have electrical conductivities in this range. Hall provides examples of several formulations of composite materials, and the largest fraction of cobalt binder in Hall's exemplary materials appears to be 11.7% by weight (see Example 1 in Hall). Given the additional presence of diamond crystals and tungsten carbide crystals in Hall's materials, and the relatively low weight percentage of cobalt, it is not at all clear that Hall's materials have electrical conductivities comparable to metals such as molybdenum. Accordingly, because of the uncertainty regarding the electrical conductivity of Hall's polycrystalline diamond composites, and because of Spaeth's explicit disclosure that connection plate 3 must have good electrical conductivity, it would not have been obvious for a person of skill in the art at the time of the invention to use Hall's materials to form connection plate 3 according to Spaeth's teaching. Instead, there would have been significant uncertainty as to the suitability of Hall's materials for use in the connection plate of Spaeth.

For all of the foregoing reasons, Applicant submits that each of claims 3 and 9 is patentable over APA, Spaeth, Hall, and Razeghi. Therefore, reconsideration and withdrawal of the rejection of claims 3 and 9 under 35 U.S.C. § 103(a) is respectfully requested.

Claim 17 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over APA in view of Spaeth and Hall. Independent claim 17 covers semiconductor devices that include, in part, an "intermediate support … formed of a diamond/metal matrix material that comprises at least one metal selected from the group consisting of copper, cobalt, and aluminum." The Action acknowledges that neither APA nor Spaeth discloses the claimed intermediate support, but states that Hall discloses a diamond composite material, and that it would have been obvious to form Spaeth's intermediate support using Hall's diamond composite material (Action at pages 7-8). Applicant respectfully disagrees.

As discussed above in connection with claim 9, Spaeth explicitly requires that connection plate 3 must have good electrical and thermal conductivity, and his disclosure implies that connection plate 3 should have an electrical conductivity that is comparable to the electrical conductivity of a metal such as molybdenum. However, there is no evidence that Hall's polycrystalline diamond materials have electrical conductivities in this range. Hall's materials include both diamond crystals and tungsten carbide crystals in addition to a relatively low weight percentage of cobalt, and it is not at all clear that Hall's materials have electrical conductivities comparable to metals such as molybdenum. Thus, due to the uncertainty regarding the electrical conductivity of Hall's polycrystalline diamond composites, and in view of Spaeth's explicit disclosure that connection plate 3 must have good electrical conductivity, it would not have been obvious for a person of skill in the art at the time of the invention to use Hall's materials to form connection plate 3 according to Spaeth's teaching. Instead, there would have been significant uncertainty as to the suitability of Hall's materials for use in the connection plate of Spaeth.

Moreover, Spaeth's mere observation that "if a connection plate material having a high modulus of elasticity is used, a hard solder, such as an AuSn alloy, is also suitable" (Spaeth, col. 5, lines 16-18) does not provide sufficient reason for a person of skill in the art to form Spaeth's connection plate from Hall's diamond composite material. The subject matter of Spaeth's and Hall's disclosures are significantly different. In particular, Hall's disclosure relates to the formation of diamond composite materials for applications such as "drilling in rock formations" (Hall, col. 6, lines 42-43). For such applications, Hall states that his materials are intended to have "improved impact resistance" (Hall, col. 2, line 53). To improve impact resistance relative to polycrystalline diamond, Hall discloses that in his materials, "[p]ieces of precemented carbide 12 have been dispersed through the polycrystalline diamond matrix 11 … [t]hese carbide pieces 12 serve the important function of absorbing impact forces in the polycrystalline diamond matrix 11 … [t]his is accomplished because the modulus of elasticity of the precemented carbide pieces 12 is lower than that of the polycrystalline diamond matrix 11" (Hall, col. 5, lines 51-58).

In contrast, Spaeth discloses laser diode components that include an "electrically and thermally conductive connection plate" (Spaeth, Abstract). Spaeth is not at all concerned with applications such as drilling in rock formations, and Spaeth's laser diode does not suffer from impact. Thus, the material properties that Hall seeks to control – namely, impact resistance and

modulus of elasticity – are of minor or no concern to Spaeth. One of skill in the art, on reading Spaeth, would have found no reason to look to Hall, as Hall discloses the formation of materials having particular properties such as impact resistance that are of little relevance to Spaeth.

Furthermore, even if, for the sake of argument only, one of skill in the art would have looked to Hall's disclosure of diamond composite materials, which Applicant does not concede, the person of skill in the art would not have combined the teachings of Spaeth and Hall for the reasons cited in the Action. In particular, the Action states that it would have been obvious "to use the diamond composite material of Hall, due to its high modulus of elasticity" (Action at page 8).

But, as discussed above, Hall states that an object of his disclosure is to improve the impact resistance of his materials by reducing the modulus of elasticity. That is, Hall introduces precemented carbide pieces into his composite materials which have a lower modulus of elasticity than polycrystalline diamond. Thus, a person of skill in the art, seeking to provide a connection plate 3 in Spaeth with a high modulus of elasticity, would not look to Hall, as Hall discloses materials with reduced modulus of elasticity.

In view of the foregoing, Applicant submits that claim 17 is patentable over APA, Spaeth, and Hall. Applicant therefore respectfully requests reconsideration and withdrawal of the rejection of claim 17 under 35 U.S.C. § 103(a).

Claim 18 has been added in the present reply. Support for claim 18 is found, for example, in pending claim 7. Claim 18 depends from claim 1, which is patentable over APA, Spaeth, Hall, and Razeghi, as discussed above. Claim 18 is therefore patentable over APA, Spaeth, Hall, and Razeghi for at least the same reasons. Accordingly, Applicant respectfully requests that claim 18 be allowed.

In view of the foregoing, Applicant asks that the application be allowed.

Canceled claims, if any, have been canceled without prejudice or disclaimer. Any circumstance in which Applicant has: (a) addressed certain comments of the Examiner does not mean that Applicant concedes other comments of the Examiner; (b) made arguments for the patentability of some claims does not mean that there are not other good reasons for patentability of those claims and other claims; or (c) amended or

canceled a claim does not mean that Applicant concedes any of the Examiner's positions with respect to that claim or other claims.

The fee for the Request for Continued Examination is being paid concurrently on the Electronic Filing System (EFS) by way of Deposit Account authorization. No other fees are believed to be due. Please apply any other charges or credits to deposit account 06-1050, referencing 12406-109US1.

Respectfully submitted,

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/Marc M. Wefers Reg. No. 56,842/
Marc M. Wefers, Ph.D., J.D.
Reg. No. 56,842

Fish & Richardson P.C.
225 Franklin Street
Boston, MA 02110
Telephone: (617) 542-5070
Facsimile: (617) 542-8906

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